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On the Trail of the Elusive Water Leak

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Many years ago, when I was working in my first water system, we knew there was a leak when we came to work in the morning and our only tank was almost empty. The treatment plant was very old and operated 24 hours a day just to furnish enough water for the community during the day and fill the single tank at night.

> *Finding a water leak is a lot like finding the proverbial needle in the haystack. There is, however, one distinct difference: A water leak is continuously trying to tell you where it is located. Water exiting a line may rumble, whistle, hiss, or in some cases, whisper; but it is continuously sending out an audible cry for help. Finding a water leak is knowing how and where to listen and what to listen for.*

The panic usually began when we came to work in the morning and the tank was dropping like a stone. We would pile into the town truck and set off on a frantic search. We would check all the usual suspects, such as creek crossings and recently repaired leaks; all the time praying a wet spot would appear in the road in front of us. After an hour or so of this foolishness, the panic subsided, and we got down to the business of actually finding the leak.

Four Ways to Find a Leak

The hardest leaks to find, of course, are those that do not surface. Water will take the path of least resistance. It can follow the gravel bedding around the line for miles, find a broken sewer line to duck into, occur in the middle of a stream, or just disappear into a fracture in the earth. Before you can pinpoint this type of leak you must first localize it (i.e., narrow down the general site of the leak). Without the luxury of metering each line, there are four basic methods that have worked well for me.

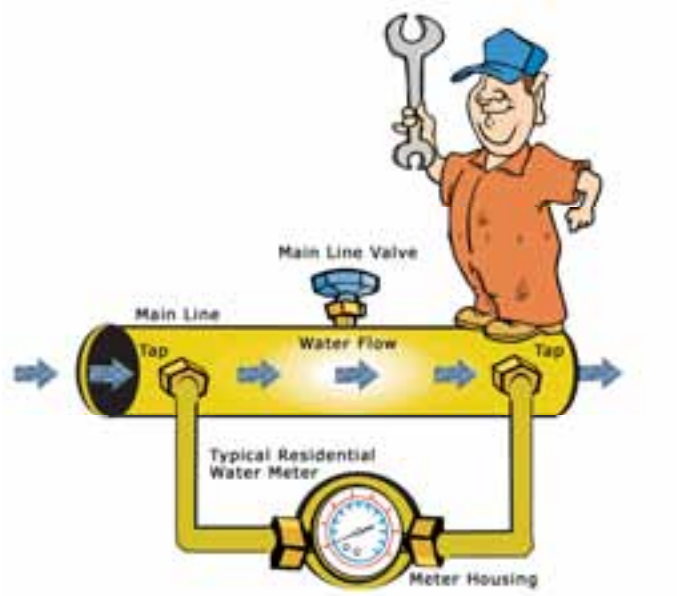
The first method, as with most leak detection measures, is most effective late at night when little water is being used. Although one person can do this, it goes more quickly, and it is much safer, when two people with some method of communication are working together. When using this particular method, always move in the direction of water flow. Pick a valve (#1) at the beginning of a particular stretch of line. Go in the direction of flow to the next valve (#2) and slowly turn the #2 valve off. Return to valve #1 and slowly turn it off. Wait ten minutes and barely crack valve #1.

Water under pressure, moving through a small space, makes a screeching or whistling sound. A metal valve wrench left on the valve will transmit that sound, and by placing your ear against the valve wrench you can hear water passing through the slightly open #1 valve. If there is no sound or if the sound quickly stops, the line is tight. However, if the noise continues, and valve #2 is tightly closed, water is leaving that stretch of line at some point between the two valves. Using this method two people can leap frog along a line fairly quickly.

The second method is very similar and is used when there is a fire hydrant connected to the suspect line. In the article I wrote about line flushing, I mentioned drilling and tapping a spare hydrant cap and installing a pressure gauge. This cap and gauge combination also works well in localizing water leaks.

This procedure is also best accomplished late at night with two people and some means of communication. Remove one hydrant cap and gently flow the hydrant to flush away anything that could foul the pressure gage. Then install the cap and pressure combination. Securely tighten all hydrant caps and charge the hydrant. After charging the hydrant, read the line pressure. One person needs to remain with the hydrant while the other closes the two valves beginning with the one downstream from the hydrant, (#2 again). After closing the downstream valve, slowly close the upstream valve, (#1). With both valves tightly closed, the line pressure should hold. If it drops off quickly, water is leaving the line somewhere. Always check with your engineer before charging a capped hydrant.

The third method is a permanent installation, which is very useful at stream crossings or lines with a history of problems. The cost and labor is minimal, and a permanent household meter installed at main line valves makes checking problem areas simple. A tap is made on the main line both upstream and down stream of the valve, and a household meter is installed between the two taps in the direction of flow. You can then close the valves on each side of the stream crossing, turn on the meter and see whether or not water continues to flow. If water continues to flow through the meter with both main line valves tightly closed, it is going into the stream. By installing a permanent meter setting, this particular method can be used to check any line. These first three methods require main line valves that work properly and shut off completely.



The Third Method: By turning the main line valve off and the meter valve on, you can tell exactly how much water demand there is on the downstream side. This permanent installation is especially good for checking water crossings. Always keep the meter valve turned off when not checking the line.

Last, but certainly not least, listening at control valves and hydrants can quickly help localize a leak. Older car mechanics know that holding a screwdriver against a valve cover and the other end tightly against your ear while the motor is running will amplify sound and allow them to check valve adjustment. The same principal can be used when looking for a hidden water leak. Water leaks make noise; you just need to listen.

If you have cast iron or ductile iron, the process becomes even easier. To demonstrate this, lay a piece of iron line and a piece of plastic line on the ground and strike each with a hammer. The iron line rings and the plastic, well, just thunks. Leaks in iron lines can be heard at much greater distances because metal carries sound well. Plastic, on the other hand, is a very poor conductor of sound, and asbestos cement is somewhere between the two. Even when using correlators, the distance between the transmitters is greatly shortened when checking plastic lines.

Left: Luther Bitzel of the Columbus Ohio Distribution Group shows the correct way to use Geophones® when working above a water line.

Above: When you get serious about leak detection, a leak correlator is state-of-the-art technology. You can check several miles of line each day with one meter precision.

Using Detection Devices

All of the leak location devices that I am aware of use some means of sound amplification. These devices run the gamut from geophones to correlators.

Geophones® have been around for years, and many people swear by them. They consist of two specially designed, heavy, brass plates connected to earpieces resembling a doctor's stethoscope. Geophones® are more convenient when the general location of the leak is known.

When you have a larger area to cover, one of the portable electronic leak locators is the next step up in both convenience and price. These devices use electronic sound amplification and allow the operator to move along at a fairly quick pace, making certain he/she is directly over the line, and setting the locator down every few steps to listen. These devices range from the very simple – a ground piece, headphones, and an on/off switch – to models that allow the operator to tune out background noise and select from a wide range of frequencies. Do a little homework, and then shop around.

The next step up is leak correlators. Like other devices, correlators are based on sound amplification with a twist. A pair of small portable amplification and transmitting devices, usually magnetic, are placed in contact with a valve, fire hydrant, exposed line etc., and spaced at varying distances, usually restricted by the composition of the line to be checked. The signal from each device is transmitted to the correlator. If the line size, location, distance between the two devices, and pipe material is known, the correlator screen can show, usually within one meter or so, where the leak is located.

Leak correlators can be expensive. But for large systems or a number of smaller systems working together, they provide not only emergency leak detection but also the ability to routinely

survey their system. Although correlators are a great tool, they require a working knowledge of basic leak detection techniques to be completely effective.

The best water leak locator I ever worked with would find a leak with the correlator then jump out of his van with Geophones® to double check. There are a multitude of other listening devices, such as small units that magnetically attach to a valve, hydrant etc., and record sound levels over long periods. This information can then be downloaded using a specific computer program allowing you to visually see sound levels. But, no matter how many electric gadgets you purchase, you still need the basics.

> ***Good Maps are Important***
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> *I cannot stress strongly enough the need for accurate maps of your system. You can really feel foolish after spending the day looking for a leak on the left side of the road, only to discover the line is actually on the right! Most leak locators, from Geophones® to correlators, are only accurate when the exact location of the line is known.*

Is that a Wet Spot?

If you are not careful, when you are looking for a leak, there will be wet spots everywhere you look. Wet spots along or in the roadway, unless they are running or the pavement is spongy underfoot, are most likely just wet spots. You should, however, always be on the lookout for vegetation that is suddenly greener and growing faster than the surrounding plants.

Looking for chlorine residual at the sight of a suspected leak can be misleading. I have questioned manufacturers of DPD chlorine reagents about interferences that could give a false color change. I have been told there are few things that can cause a pink color change other than chlorine itself. Be that as it may, I have dug some pretty large holes where there was neither a water leak nor a water line only because the grab sample turned pink when the reagent was added. Also, if the running water is actually a leak, the path from the leak to the surface may find a chlorine demand causing no residual to actually reach the surface.

In my opinion, fluoride residual is the best indicator, provided that your water is fluoridated. If the fluoride residual reaching the surface closely matches the residual in your system, there's a good probability that the water is coming from one of your lines. Many years ago one of the prevalent chlorine reagents was orthotolodine. Orthotolodine turns yellow in the presence of chlorine and did not appear to have any interference. It was discovered to be carcinogenic several years back and ordered out of treatment plants.

Locating hidden water leaks takes practice and even the best dig a lot of dry holes. Yes, the leak is continuously telling you where it is. However, the language is foreign and you must learn it.

About the Author

Larry Rader has more than 25 years in the water industry. If you have a question for Mr. Rader, he can be reached by e-mail at lrader@meer.net

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